Exit Presentation

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Overview

- My Background
- Project Background
- My work for the project
- My summer and future plans

My Background

San Antonio, TX

Summer ‘11
NASA JSC, NSBRI

Summer ’08
Bell Helicopter
A Textron Company
Rotor Blade Design

TEXAS
B.S. ASE ‘09

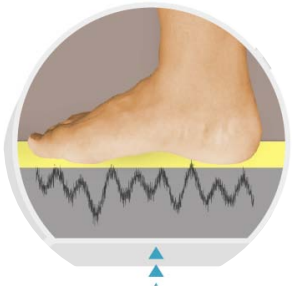
S.M. ‘12
Aero/ Astro
Chuck Oman
Telerobotics

Summer ’09
NASA JSC, USRP
EA3: Lunar Habitats

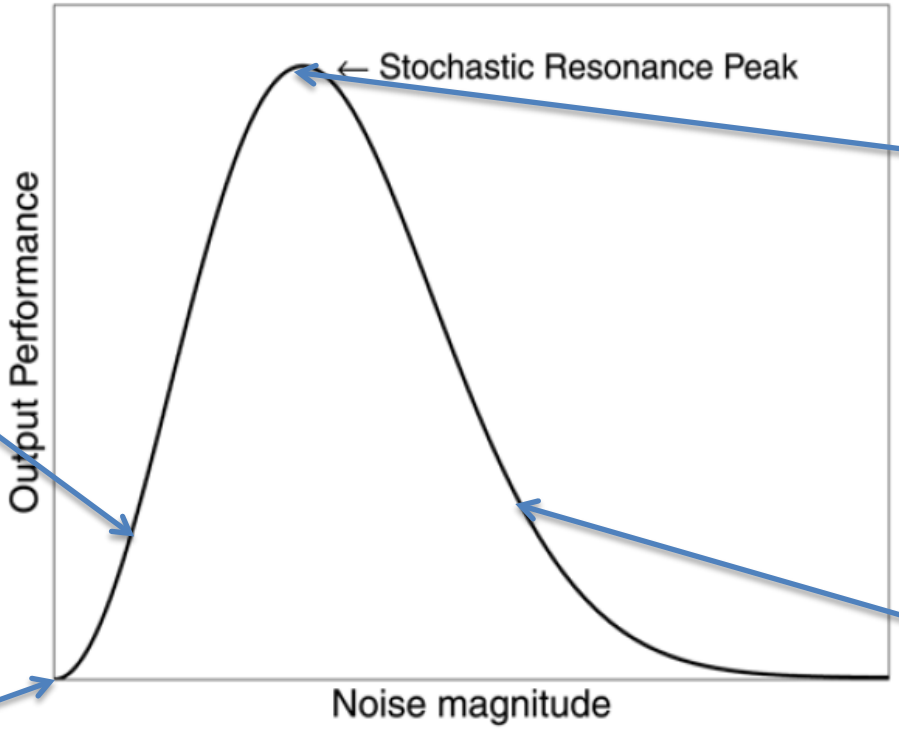
Summer ’10
NASA KSC
ASRC AEROSPACE
Hazardous Gas and Detection Lab

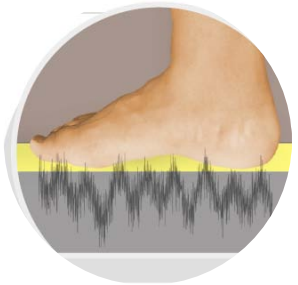
Stochastic Resonance

Stochastic resonance is a phenomenon in which the response of a non-linear system to a weak input signal is optimized by the presence of a particular non-zero level of noise.

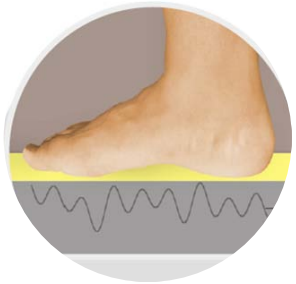


2. Some Sensation





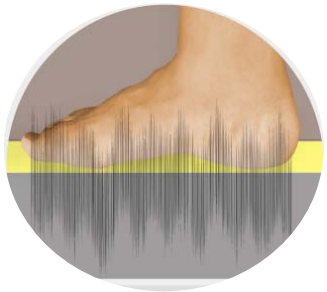
3. Peak Sensation



Threshold of sensation

Mechanical Signal

1. No Sensation



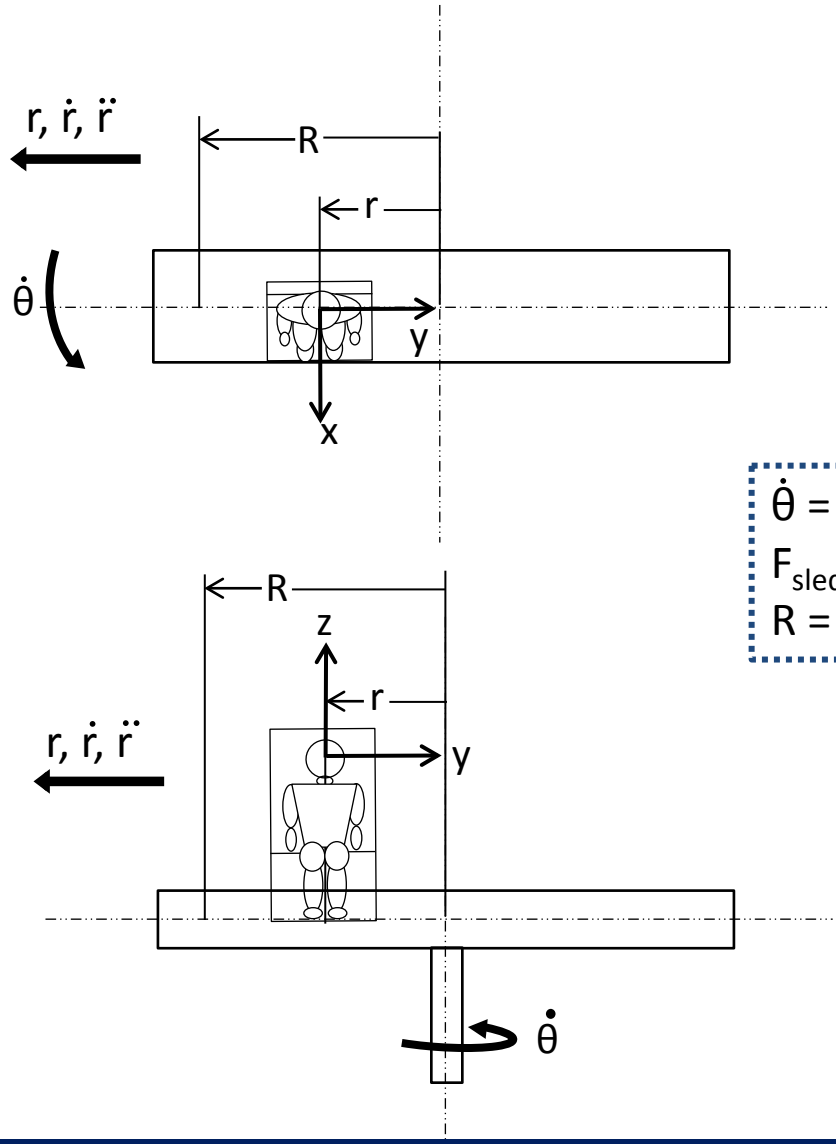
4. Decreased Sensation

Typical curve of output performance (e.g. discrimination index) vs noise magnitude - McDonnell MD and Abbott D., PLOS Computational Biology, May 2009, Vol 5 (5)

Harry J, Niemi JB, Priplata AA, Collins JJ, IEEE Spectrum, April 2005.

The goal of this project is to determine the efficacy of a vestibular stochastic resonance countermeasure during low frequency perturbations (0.1 - 2 Hz) on ocular motor and perceptual responses

Variable Radius Centrifuge

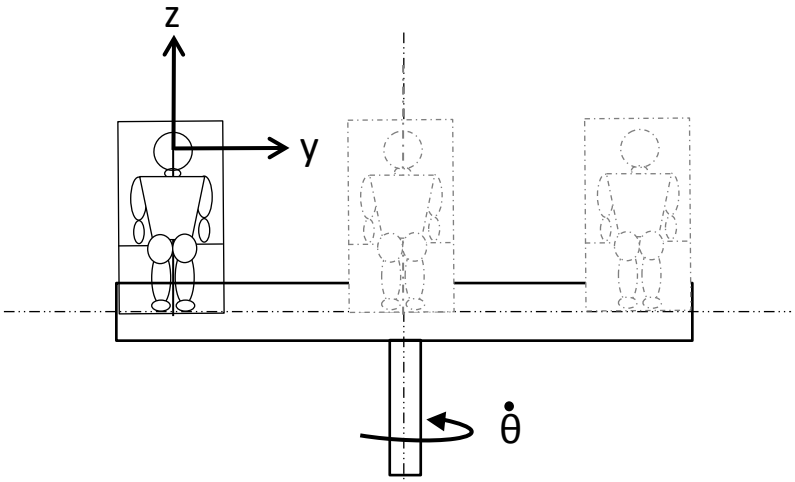


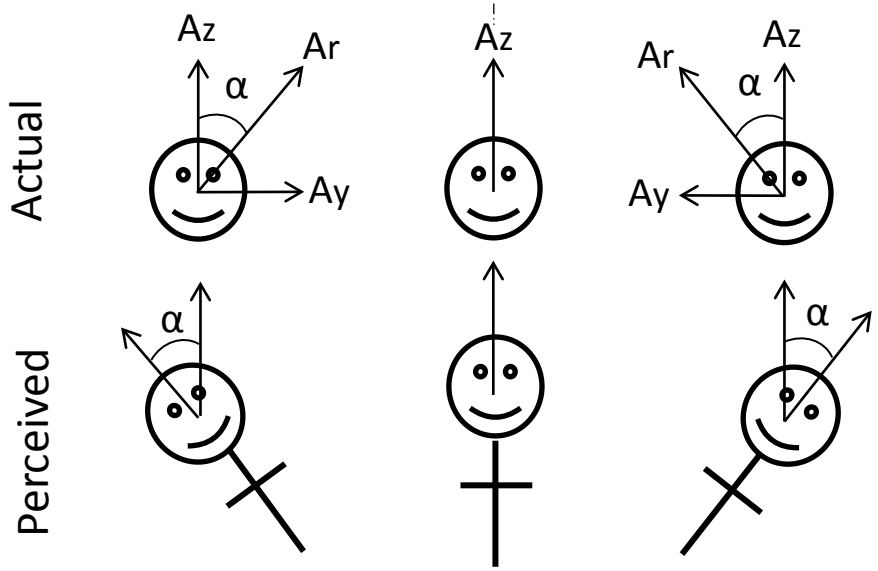
$\dot{\theta}$ = 216 °/s

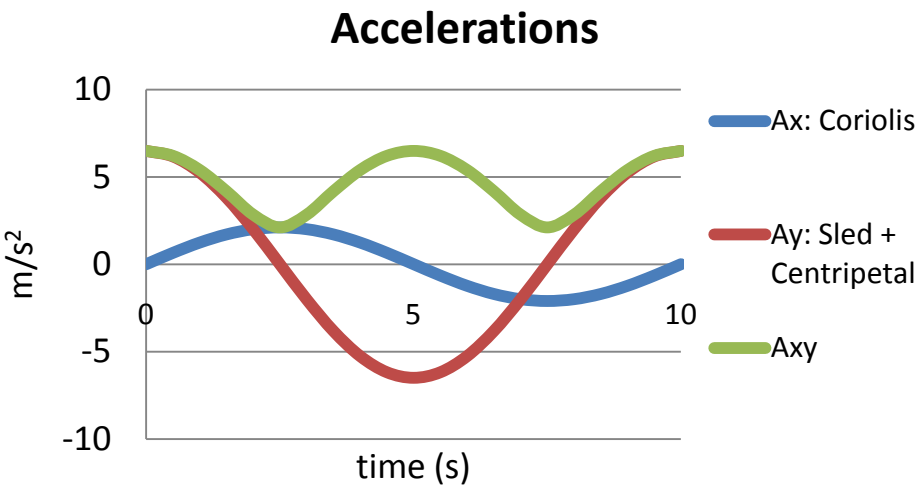
F_{sled} = 0.1 Hz

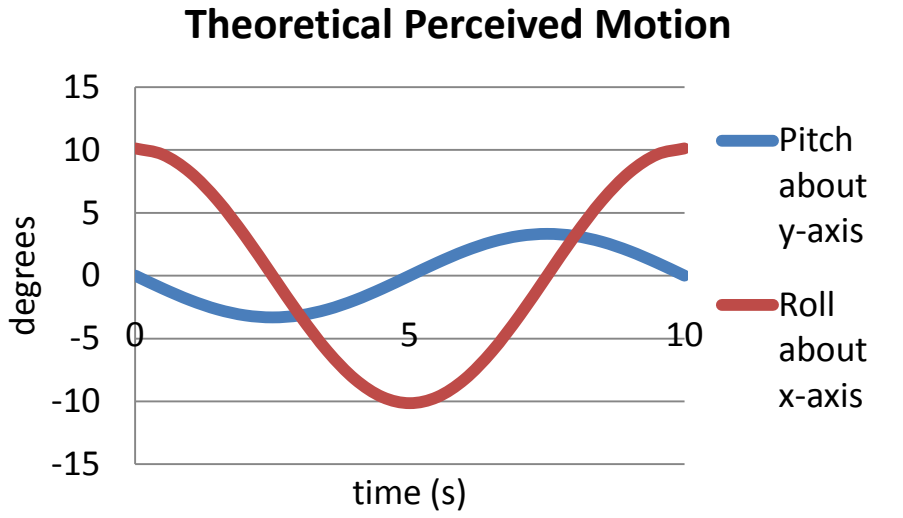
R = .12 m

Perceived Motion



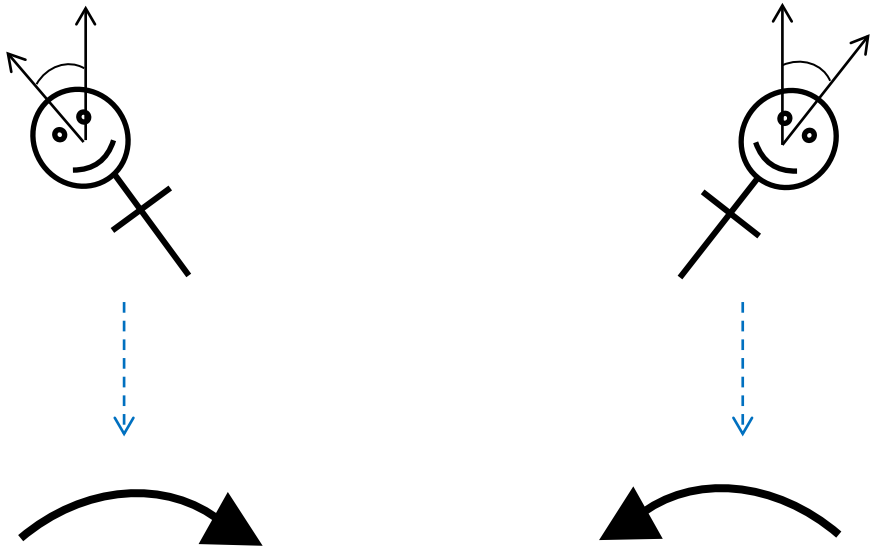




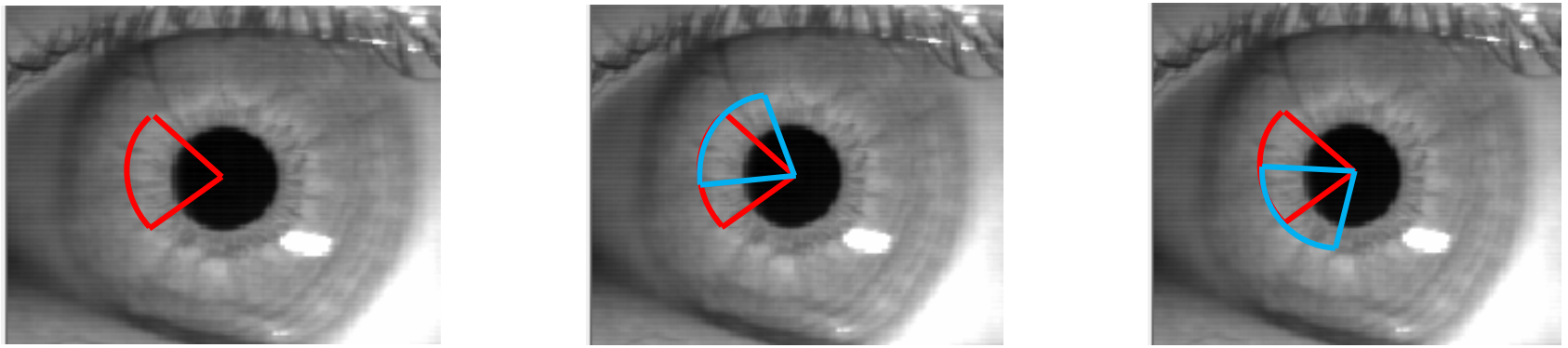


Torsional Eye Movement

Actual or Perceived Body Orientation:

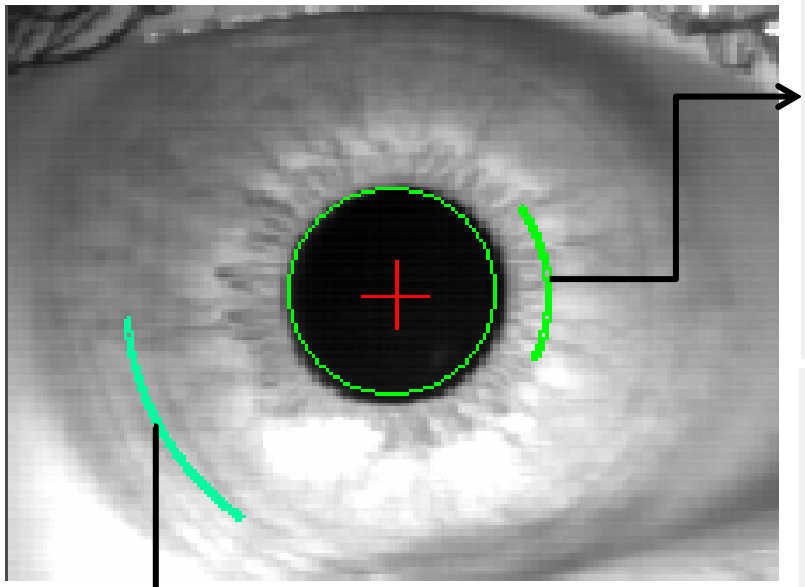


Corresponding Eye Counter-roll:



Reference Frame

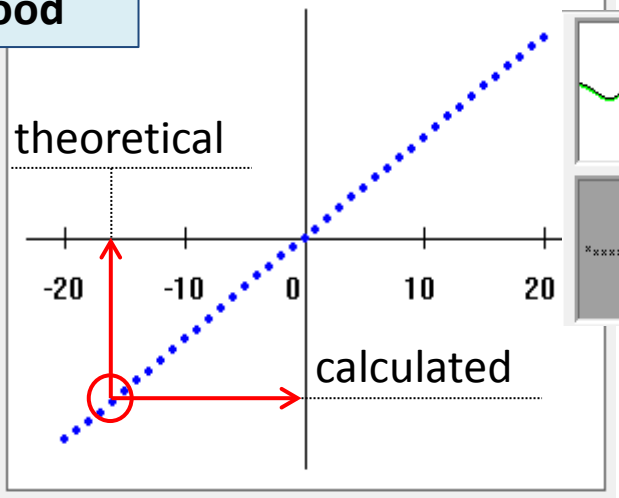
Chronos Eye Tracking: Segment Selection

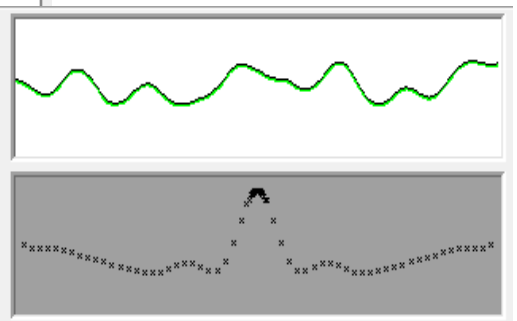


Linearity Check

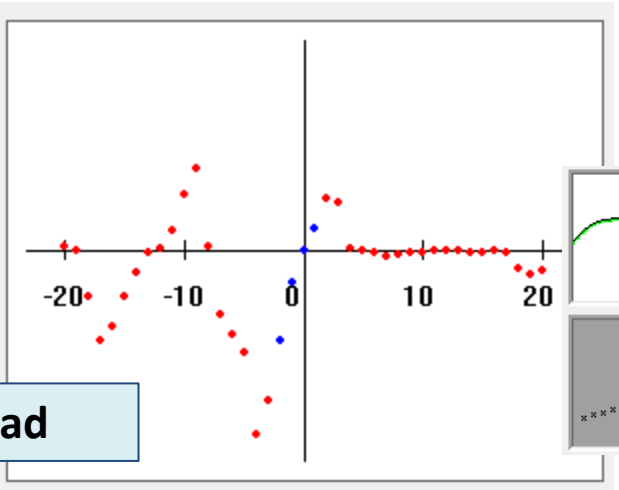
Correlation Function

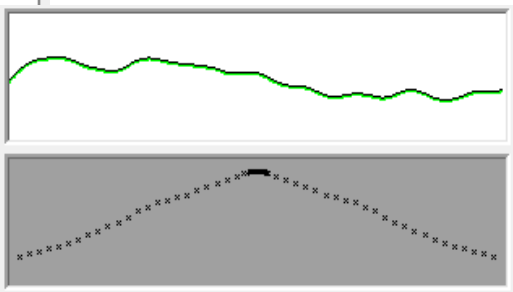
Good





Bad



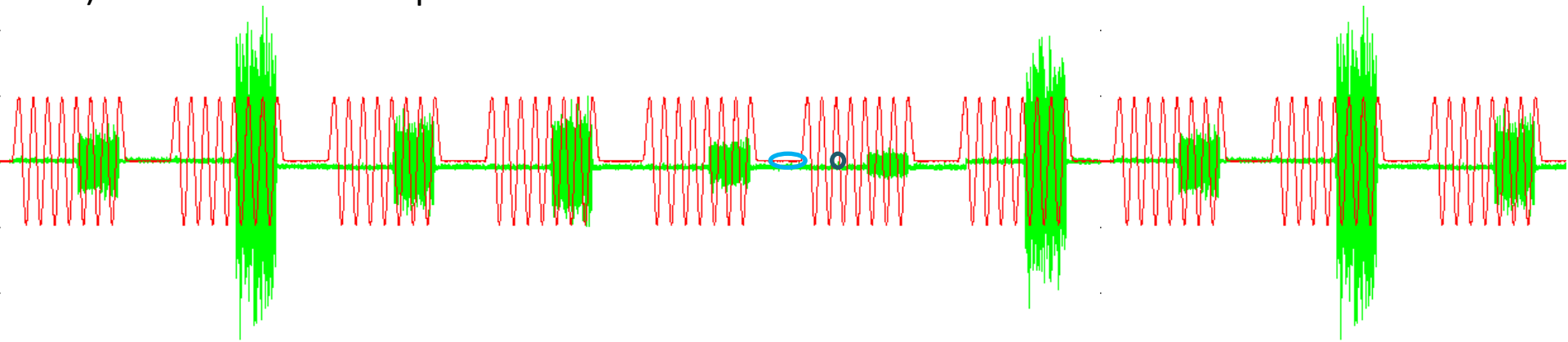


Details

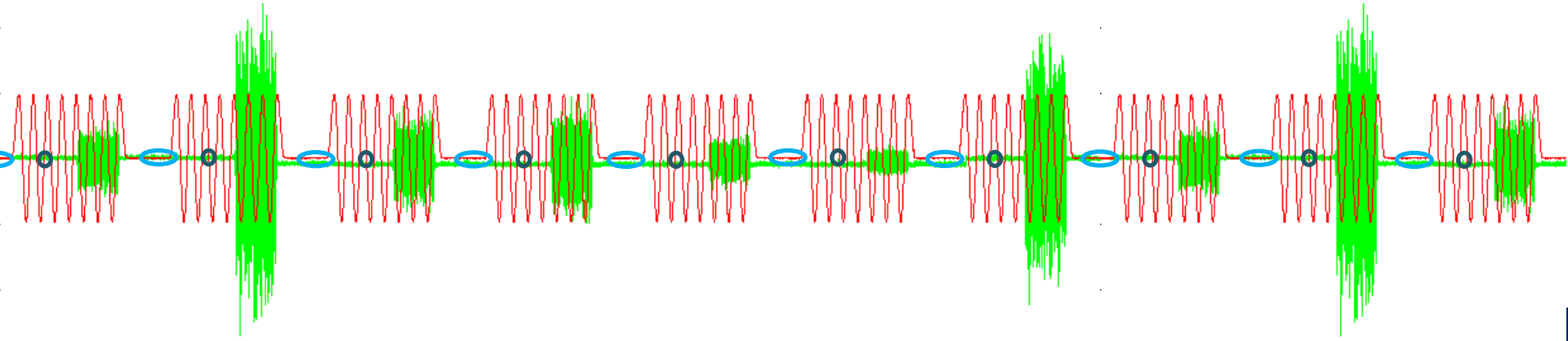
Goal: Optimize methodology for estimating counter- roll motion

-Track data using 4 different reference frame methods and evaluate results

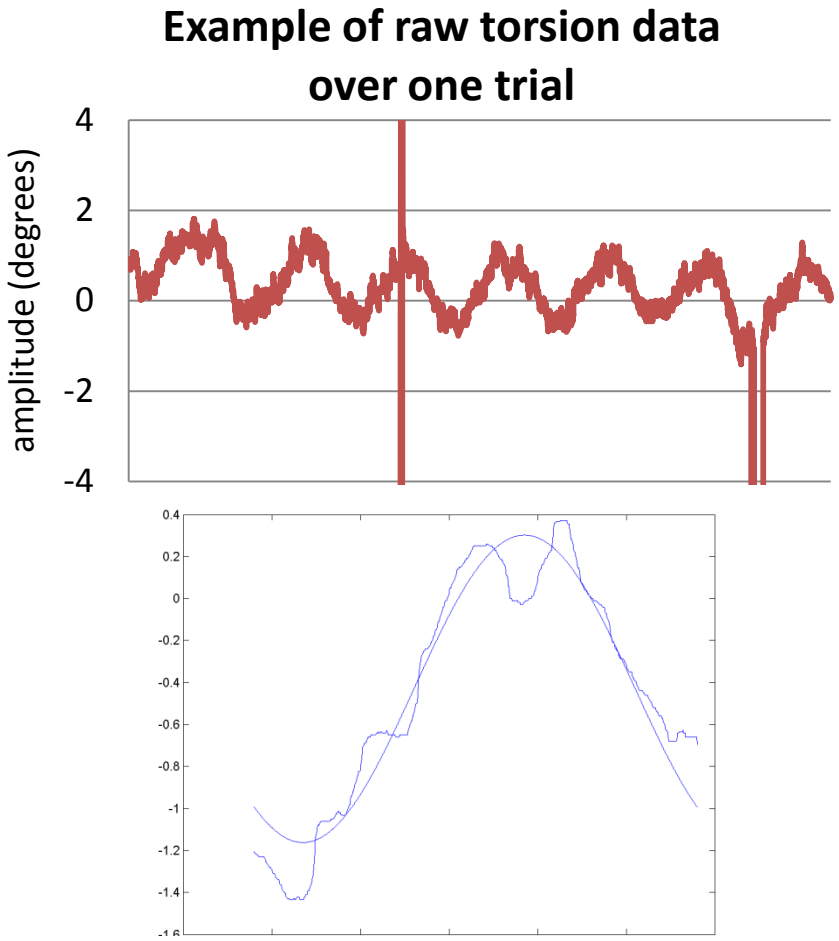
1) 1 RF in No Oscillation period
2) 1 RF in Oscillation period

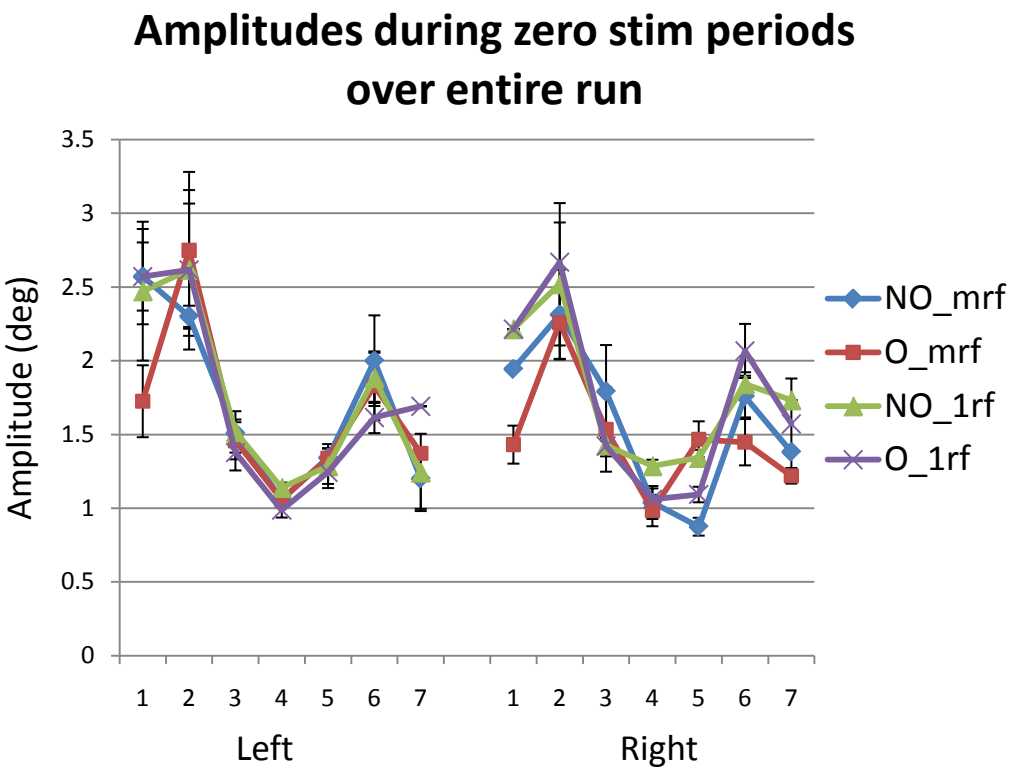


1) Multiple RFs in No Oscillation period



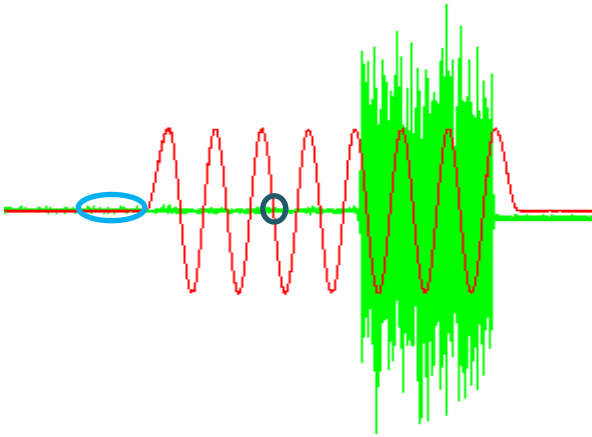
Zero Stim Comparison





Overall, all 4 RF options yielded similar results…

Conclusions



No Oscillation vs. Oscillation

- Pro No Oscillation: -provides larger window of frames to chose RF from in case of blink, obstruction, etc.

Multiple RFs vs. 1 RF

- Pro 1RF: -Saves time, ≈ 10x faster
- Cons 1RF: -With larger N, may see more inaccuracy at start and end of run

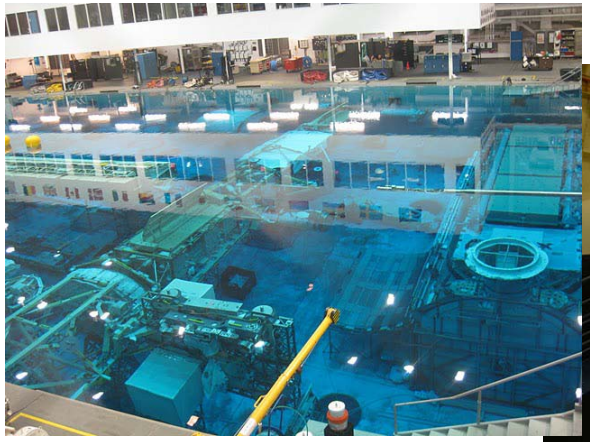
- Pro MRF: -Enables us to choose best segment for each trial
  - Important for this relatively long run

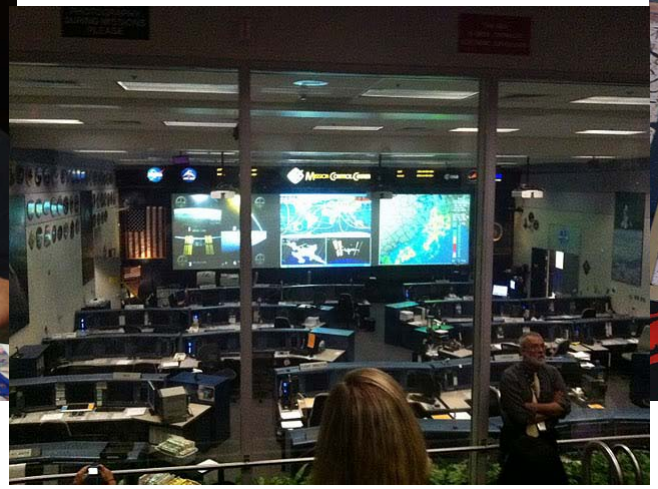
Going Forward

- Make data collection as good as possible
  - No eye makeup
  - Level and defined eye fixation point
  - And of course, encouraging subjects to keep their eyes open wide!

- Make changes to code
  - Automate some steps in the process
  - Make analysis more robust to imperfect data

Summer at JSC





Future Plans

- Finish Master's degree
- Possibly go for a PhD?
- Hopefully end up back at JSC!

Acknowledgements

Mentor: Dr. Ajit Mulavara

Mathew Fiedler , Patricia Santana,

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